Novel Method for Encoding Microtext Data Within Durable Crystals Readable Using Low-Tech Means sc. Compound Microscopes in Support of "Doomsday" Data Continuity Preparedness

28 August 2022
Simon Edwards
Research Acceleration Initiative

## Introduction

Crystals, given that they are able to survive extremes of climate and tolerate effortlessly even deliberate attempts at their destruction have long been eyed for their potential as a comparatively low-density, high-stability (even more enduring than a stone tablet) data storage mechanism.

## Abstract

In the event of a near-total extinction of the human race, it may take hundreds or even thousands of years for civilization to reconstitute itself to the point where people may begin to think about resurrecting the world that once existed. The trouble is that if it takes more than about a couple of decades for humanity to get back on its proverbial feet, any electronically stored (on hard drives) information would likely be permanently lost. Information concerning, for example, how to build a microprocessor and how to build a hard drive is stored, you guessed it, on hard drives. Thus, any major disruption to our supply chain would lead to a permanent and catastrophic amnesia from which we might never recover unless we find a way to encode critical information on crystals readable with simple microscopes. Our history, important literary works, and technical schematics can all be encoded into crystals.

I propose that a synthetic crystalline substance be identified in which non-UV light would have the traditional tendency to follow the path set by the latticework of the structure, but which has no prismatic effect on UV light. The reason why will be explained.

In the process of synthesizing this crystal, in a high-pressure/heat environment, bubbles, each of which would consist of a blend of helium and fluorine gas, would be introduced to the temporarily liquefied crystal. The crystal is held in a state bordering a liquid and a solid, one which allows these bubbles to shift their position within the structure but one which also tends to channel infrared light along the established pathways of a lattice. Thus, the pressure chamber used to synthesize these crystals would need a non-traditional component: A light source operating inside of the box.

The electrostatic repulsion of the light interacting with the fluorine would gradually cause the bubbles to diffuse into a perfect grid offset from the nodes of the lattice. The bubbles would ideally be about a tenth of a micron in diameter each.

After diffusion is complete, the crystal is allowed to cool, locking the bubbles in place. The position of the bubbles being highly predictable, data could then be written into the crystal in the following way:

Three focused UV laser beams would converge on a given bubble in order to deliver an amount of energy sufficient to excite the fluorine atoms. One such beam would be insufficient to encode information, which means that only at a three-dimensional point of convergence would data be successfully written.

This would be the mechanism by which control over where within the three-dimensional structure data is written. The fluorine component, which would normally occupy the center of a bubble (shielded from reactivity and consequent chemical binding to the carbon of the crystal by the helium) would, in the event a bubble is struck with powerful UV light, jump toward the periphery and form a permanent chemical bond with the carbon of the crystal. This binding would alter the optical properties of the fluorine, morphing it from a barely-reflective pale yellow color to now appear as a bright yellow dot rather than a faint yellow one.

Configurations of dozens of dots could be made to represent a letter of the alphabet and would be visually discernible using a compound microscope. Each letter would, including the spaces next to (and behind) each letter take up about two cubic microns each, although the granularity would depend upon the ability to inject fine enough bubbles into the forming crystal as well as the ability to control the focal plane of a microscope. At two cubic microns per character, a seven cubic centimeter crystal could comfortably store a thousand books. The data could be read manually in a doomsday scenario using an optical microscope by carefully varying the focal plane and moving the crystal in small increments. Data could be read much more rapidly if advanced computer equipment survives or is re-developed using the knowledge stored on the crystals. Any data represented in Roman characters could be successfully interpreted by any computer with an Optical Character Recognition (OCR) capability.

## Conclusion

This approach fulfills all of the primary requirements for such a system: That it be able to store large quantities of data in a highly-durable medium taking up a minimum of physical space, that data be rapidly and affordably encodable, and that said data be discernible without the use of electronics.